UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

OCT 22 2002

In Reply Refer To:
SWA-00-SA-5807:MTM

Frank Michny
Regional Environmental Officer
Bureau of Reclamation
2800 Cottage Way
Sacramento, California 95825-1898

Dear Mr. Michny:

Enclosed is a biological opinion pursuant to section 7 of the Endangered Species Act (ESA) which analyzes impacts to the threatened Central Valley steelhead (*Oncorhynchus mykiss*) from the proposed Lower Mokelumne River Restoration Program (LMRRP) Fish Passage Improvements (Enclosure 1). Also enclosed is the National Marine Fisheries Service's (NOAA Fisheries) Essential Fish Habitat (EFH) Conservation Recommendations as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) for the Pacific coast salmon, which may be affected by the proposed action (Enclosure 2).

The Bureau of Reclamation (BOR), in cooperation with the Woodbridge Irrigation District (WID) and the City of Lodi, proposes to remove and replace the existing Woodbridge Dam and its fish-passage facility, and relocate the WID's diversion intake. Based on the best available scientific and commercial information, NOAA Fisheries concludes that the proposed project is not likely to jeopardize the continued existence of Central Valley steelhead. An Incidental Take Statement is included with the biological opinion that identifies Reasonable and Prudent Measures and Terms and Conditions to implement those measures, to ensure that the impacts of any incidental take are minimized.

Consultation with NOAA Fisheries must be reinitiated if (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals that the project may affect listed species in a manner or to an extent not previously considered; (3) the action is subsequently modified in a manner that causes an effect to the listed species that was not considered in the biological opinion; or (4) a new species is listed, or critical habitat is designated that may be affected by the project.

If you have any questions or concerns about this consultation or the consultation process in general, please, feel free to contact Madelyn T. Martinez at our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814-4706 at (916) 930-3605 or by FAX (916) 930-3629.

Sincerely,

Rodney R. McInnis
Acting Regional Administrator

cc: NOAA Fisheries-PRD, Long Beach, CA
Stephen A. Meyer, ASAC, NOAA Fisheries, Sacramento, CA
Steve Thomas, NOAA Fisheries, 777 Sonoma Avenue, RM 325, Santa Rosa, CA 95404
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LOWER MOKELUMNE RIVER RESTORATION PROGRAM: FISH PASSAGE IMPROVEMENTS on the WOODBRIDGE DAM AND WID DIVERSION CANALS

BIOLOGICAL OPINION
(Endangered Species Act - Section 7 Consultation)

and

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS
(Magnuson-Stevens Fishery Conservation and Management Act - EFH Consultation)

Prepared by
National Marine Fisheries Service
Southwest Region

Enclosure 1

BIOLOGICAL OPINION

Agency: U.S. Bureau of Reclamation, Sacramento District

Activity: Lower Mokelumne River Restoration Program (#1425-8-FC-20-16650)

Consultation Conducted By: Southwest Region, National Marine Fisheries Service.

Date Issued: OCT 22 2002

I. BACKGROUND AND CONSULTATION HISTORY

The first fish ladder at Woodbridge Dam was built in 1925. However, the ladder was poorly designed and failed to provide suitable passage conditions for salmon and steelhead. A more effective fish ladder was constructed in 1948 but was washed out during a flood in 1950. Finally, the existing fish ladders were constructed in 1955. Although these ladders provide adequate passage for adult Chinook salmon and steelhead, studies have recommended that improvements be made to avoid potential delays in migration (BioSystems 1992; Vogel Environmental Services 1992; CALFED Bay-Delta Program [CALFED] 1998).

Historically, downstream passage of juvenile salmon and steelhead in the Lower Mokelumne River has been affected by diversions at the Woodbridge Irrigation District (WID) Diversion Canal, the North San Joaquin Water Conservation District (NSJWCD) pumps, and numerous riparian pumps. The WID Diversion Canal was unscreened for decades and was considered a major source of salmon losses from the Mokelumne River (Fry and Petrovich 1970, as cited by BioSystems 1992). In 1968, the WID Diversion Canal was screened by the California Department of Fish and Game (DFG) to prevent further losses of outmigrating salmon and steelhead. Although the screen has been operating since its installation and has kept fish out of the canal, it does not meet current DFG fish screen criteria for approach velocity and mesh size (BioSystems 1992; CALFED 1998; George Heise, John Nelson, and Cynthia Watanabe, DFG, pers. comm., February 22, 2001). Recent observations at the screen have revealed several potential problems, including inefficient fish guidance structures, improper seals at the screen joints, and deficiencies in the configuration of the bypass intake (Vogel Environmental Services 1992).

Because of these potential problems, the Lower Mokelumne River Restoration Program (LMRRP) of the U.S. Bureau of Reclamation (BOR) was developed and is intended to be a comprehensive ecosystem restoration program designed to address key factors that affect the

viability of anadromous fish populations and other wildlife species in the Lower Mokelumne River. The stated primary goals of the LMRRP are to 1) implement elements of existing resource management plans to substantially increase fall-run Chinook salmon and steelhead populations, 2) enhance critical and limiting aquatic habitats, and 3) restore riparian ecosystem integrity and diversity.

A major component of the LMRRP includes improvement of fish passage at Woodbridge Dam and the installation of a new fish screen at the WID Diversion Canal. These improvements are intended to remedy factors that currently limit the viability of anadromous fish populations in the Lower Mokelumne River. Delays and losses of juvenile salmonids migrating downstream past the WID Diversion Canal, delays of adult salmonids migrating upstream past Woodbridge Dam, and losses of juveniles due to predation are some of the factors supporting the need for the proposed improvements (DFG 1991, 1993; U.S. Fish and Wildlife Service [FWS] 1995; CALFED 2001). The goals of the LMRRP fish passage project are to 1) improve upstream and downstream fish passage in the Lower Mokelumne River in the vicinity of Woodbridge Dam; 2) increase operational flexibility to pass fishery flows, including pulse flows, downstream in accordance with East Bay Municipal Utility District's (EBMUD's) Joint Settlement Agreement (JSA) and other fish flow requirements; and 3) maintain WID's access to its full water right entitlement.

The proposed project at the Woodbridge Dam and WID Diversion Canal was developed through a collaborative effort of all member agencies of the LMRRP Technical Committee (Technical Committee). The Technical Committee includes the project sponsors (WID and the City of Lodi), and representatives from EBMUD, the National Marine Fisheries Service (NOAA Fisheries), FWS, and DFG.

NOAA Fisheries has been participating in meetings of the Lower Mokelumne River Technical Advisory Committee (MRTAC) since 1997. In fall 1998, MRTAC Work Group (Work Group) was formed to oversee the development and implementation of the LMRRP as an effort to improve conditions for anadromous fish on the Lower Mokelumne River. NOAA Fisheries has participated in numerous meetings of the Work Group since it was formed, and has provided guidance to the project sponsors and BOR on the development of alternatives and methodologies to be used in the analysis of impacts, review of the draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS), and selection of the Preferred Alternative. Some Work Group members also are members of the Technical Committee and have provided input on the final design of the Woodbridge dam and WID Diversion Canal fish screens.

Significant progress towards formal consultation was marked by the following events:

On December 28, 1998, NOAA Fisheries received the EIR/EIS Notice of Preparation/Notice of Intent information package from BOR and WID.

In November 1999 NOAA Fisheries received a copy of the Draft EIR/EIS for the LMRRP from

BOR and WID. NOAA Fisheries submitted comments on the Draft EIR/EIS to BOR and WID on January 4, 2000.

On May 16, 2000, NOAA Fisheries received a copy of the Final EIR/EIS for the LMRRP from BOR and WID.

On August 30, 2000, BOR submitted a biological assessment (BA) to NOAA Fisheries and requested formal consultation under section 7 of the federal Endangered Species Act (ESA) regarding the effects of the proposed LMRRP's fish passage improvements and fish screen installation on threatened Central Valley steelhead (*Oncorhynchus mykiss*) and their designated critical habitat (65 FR 7764). Consultation regarding Essential Fish Habitat (EFH) for Central Valley fall-run Chinook salmon also was requested. Although NOAA Fisheries did not submit a written request for additional information to BOR, redesign of several project components necessitated a revision of the BA (see below).

On February 22, 2001, NOAA Fisheries staff met with the Technical Committee and Work Group to discuss the proposed project description. NOAA Fisheries and DFG staff concluded that the proposed project would not meet NOAA Fisheries or DFG fish passage or fish screen criteria, and should be redesigned. An alternative project design was announced at the March 6, 2001 Technical Committee meeting which addressed most concerns that had been raised. NOAA Fisheries engineering staff met and corresponded with BOR and WID representatives on March 22 and 26, April 24, and May 10, 2001 to assist with further modifying the project design.

On December 18, 2001 NOAA Fisheries received a revised BA. A meeting was held on December 26, 2001 with BOR and WID representatives to discuss NOAA Fisheries' comments on the revised BA and additional changes to the project description.

BOR reinitiated formal consultation on January 9, 2002, using the revised BA and updated designs for WID's new dam, fish passage facilities, intake diversion canals, and fish screen. NOAA Fisheries responded on January 16, 2002 with letter stating that additional information was needed to complete the initiation package. A meeting involving representatives from BOR, WID, and NOAA Fisheries was held on January 17, 2002 to discuss the additional information needed to complete the initiation package, and also to discuss potential terms and conditions of the biological opinion for the project.

NOAA Fisheries received an addendum to the revised BA on January 28, 2002; construction specifications, finalized design plans, and the fish screen and fish passage facilities operation and maintenance manual on February 6, 2002; geotechnical survey for the project site on February 8, 2002; fish passage facilities performance monitoring plan manual on February 14, 2002; and additional information regarding engineering specifications on March 12, 2002. After reviewing all of the additional information, the initiation package for formal consultation was considered complete and a letter confirming this was sent to BOR on April 24, 2002.

This biological opinion is based on information provided in the revised BA and addendum; finalized designs, operation and maintenance plans for fish passage at the Woodbridge Dam and fish screen at the WID diversion canal; meetings and site visits involving NOAA Fisheries staff, and written correspondence and phone conversations between NOAA Fisheries staff and representatives of BOR, WID, EBMUD, and DFG. The administrative record for this consultation is maintained at the NOAA Fisheries Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, California, 95814.

II. DESCRIPTION OF PROPOSED ACTION

BOR and WID propose to improve fish passage in the Lower Mokelumne River by replacing the existing Woodbridge Dam with a new, adjustable weir/dam that includes three fish ladders and a fish counting and imaging system; installing a new pipeline for water diversion that includes a low-stage fish screen; installing a high-stage fish screen and fish bypass pipeline at the existing WID Diversion Canal; building a fish monitoring facility; and modifying the existing fish ladder into an adjustable, false weir to capture adult salmonids for monitoring or research purposes. The high-stage fish screen will be a "V" type fish screen located that will operate between 0 and 414 cubic feet second (cfs) during full reservoir conditions when lake water surface elevations are between 39.5 and 40.6 feet mean sea level (MSL) at the canal. The low-stage fish screen will be a flat plate located immediately upstream of the east side of the new dam and above the three proposed fish ladders. This screen will operate between 0 and 200 cfs and enable outmigrating juvenile salmon and steelhead to pass safely by preventing them from entering the proposed diversion pipeline. The new ten-foot diameter concrete diversion pipeline will convey diverted water from the low-stage fish screen 1,800 feet across but underneath the streambed of the Mokelumne River, and connect to the existing WID Diversion Canal entrance. The installation of the pipeline will not increase the amount of water diverted from the Lower Mokelumne River compared to the present conditions.

A. Action Area

The action area is defined as "...all areas to be affected directly or indirectly by the Federal Action and not merely the immediate area involved in the action" (50 CFR § 402.02). The action area for this consultation is within San Joaquin County, California and includes: (1) portions of the Lower Mokelumne River directly 200 feet upstream and 100 feet downstream of the proposed Woodbridge Dam (RM 15), and (2) the entrances of the existing WID Diversion Canal and diversion pipeline adjacent to the Woodbridge dam and upstream above Lodi Lake Park.

B. In-channel Construction Activities

The proposed project will require extensive in-channel construction throughout the year. There

are five construction elements (see below) that are sequenced to allow continuous fish passage as well as for WID to continue its operation during in-channel construction. Essentially all of these construction elements will require the installation of sheet-pile coffer dams and trestles to facilitate dewatering of work areas and worker access, respectively. Dewatering of work areas will occur with cased wells and submersible pumps that discharge to a settling pond located behind the existing levee. Clean water decanted from the settling pond will be returned to the river. In-channel staging areas and construction equipment will be confined to the limits of the cofferdams. To maintain fish passage, at least one half of the stream channel and one fish ladder (i.e., either the existing fish ladder or one of the new fish ladders) will be open with flowing water at all times. Upon completion of construction activities, coffer dams and trestles will be removed and work areas will be returned to preconstruction conditions by removing construction debris, grading the areas to their original contours, and revegetating disturbed riparian areas with native plants.

1. Construction Element 1: Adjustable Weir and Fish Ladders

A new adjustable weir and three fish ladders will be constructed immediately upstream of the existing dam. Work will occur in two phases involving isolation of approximately half of the stream channel, existing dam, and new weir site during each phase.

During each phase, with the work area dewatered, the existing facilities will be removed and concrete will be poured for the foundations of the new dam and fish ladders. The dam panel sections will be installed with a crane when the concrete has cured. To protect the bank from erosion and undercutting, a low sheet-pile wall and approximately 150 feet of rip rap will be installed adjacent to the river's right bank beginning at the downstream edge of the fish ladder. The rip rap will be installed with an excavator from the shoreline.

2. Construction Element 2: High-Stage (0-414 cfs) Fish Screen and Fish Bypass Pipeline

The high-stage fish screen will be a "V" type fish screen located at the entrance to WID Diversion Canal, which will continue to operate during construction of the new facilities. With the work area dewatered, the existing fish screens, operators, slide gates, and steel frame will be removed. Remaining facilities will be demolished, and concrete will be poured for the foundation of the new fish screen. A crane that is stationed on the trestle will install the remaining components of the screen.

Installation of the fish bypass pipeline will require excavation of a 4-foot-wide trench and removal of some riparian vegetation along the left bank of the Mokelumne River. Concrete will be poured over approximately 800 feet of pipe placed in the trench. The terminal 150 feet of the bypass pipeline will connect the smolt trap (see Construction Element 3, below) to a downstream discharge point.

3. Construction Element 3: Smolt Trap, Monitoring Building, False Weir, and Adult trap

Installation of the smolt trap, monitoring building, and the modification of the existing fish ladder to accommodate construction of the false weir as an adult fish trap will take place during construction of Construction Element 1, Phase 2 facilities (i.e., left half of the new weir dam). Concrete will be poured for each foundation, and a crane will install the remaining components seven days after the concrete and past site inspections.

4. Construction Element 4: Fish Counting and Imaging System

The fish counting and imaging system will be constructed in conjunction with the fish ladders. Electrical conduits and conductor wire will be installed to connect the VAKI ® imaging system from the building to monitoring points on the high-stage and low-stage fish ladders. Lighting for the video camera systems will be installed on the high-flow and low-flow fish ladders located on the right bank of the dam.

5. Construction Element 5: Low-Stage (0-200 cfs) Fish Screen and Diversion Pipeline

The low-stage fish screen will be a vertical flat plate located immediately upstream of the ladders on the right abutment of the weir. Installation of the low-stage fish screen will require excavation and realignment of the right bank of the river; excavators, front-end loaders, and bulldozers will perform this work. Excavation equipment will access the area along existing levee roads. Concrete will be poured to form the structural components of the fish screen; a crane will place the prefabricated components.

The 10-foot diameter diversion pipeline will begin at the WID Diversion Canal, cross the west and east channel of the Mokelumne River and extend to the east side of the river levee. This pipeline will be buried beneath the streambed. This part of the proposed project may require construction of two sand/gravel berms for one or both channel crossings. The berms will be situated upstream and downstream of the pipeline crossing, with sufficient distance between them to accommodate the sheetpile cofferdams (i.e. about 50 feet apart). In addition to dewatering the construction area, the berms will serve as temporary construction access and staging areas on either side of the sheetpile cofferdam. A maximum of 1,500 cubic yards of gravel will be placed for all berms. All affected areas will be returned to preconstruction conditions upon completion of construction activities.

Procedures and measures to avoid and minimize impacts to listed species that are to be included as part of the proposed project action include the following:

1. **The general contractor will be required to develop an Erosion-Control Plan and obtain necessary permits and clearances for in-channel work.** Standard erosion-control measures (e.g., management, structural, and vegetative controls) will be implemented for all construction activities that expose soil. Erosion in

disturbed upland areas will be controlled by regrading to eliminate direct routes for conveying runoff to drainage channels, constructing erosion-control barriers such as silt fences and applying mulching material, and reseeding disturbed areas with grass or other plants.

Before regrading the channel bottom near Woodbridge Dam, sediment core samples will be collected and analyzed for metals and organochlorine compounds (hydrocarbon pesticides that contain chlorine). If toxic substances are found to be present in concentrations exceeding the regulatory thresholds for hazardous waste, the graded material will be transported and disposed of in an appropriate hazardous-waste disposal facility. The contractor will also be required to ensure that the gravel/sand mixtures used for berm construction and as fill contain less than five percent silt by volume.

Permits that may be required for the proposed action include a National Pollutant Discharge Elimination System stormwater permit for general construction activity from the Central Valley Regional Water Quality Control Board (RWQCB), and a Streambed Alteration Agreement from DFG.

2. **The general contractor will be required to develop and implement a Hazardous Materials Control and Spill Prevention and Response Plan.** WID will review the plan to verify that measures have been incorporated to control the use of hazardous materials and reduce the chance of spills to the maximum extent practicable. In addition, WID will conduct on-site inspections to ensure compliance with these measures. The Hazardous Materials Control and Spill Prevention and Response Plan will require the general contractor to do the following:
   - Prevent raw cement; concrete or concrete washings; asphalt, paint, or other coating material; oil or other petroleum products; or any other substances that could be hazardous to aquatic life from contaminating the soil or entering watercourses.
   - Develop and implement strict onsite handling rules to keep construction and maintenance materials out of drainages and waterways.
   - Clean up all spills immediately in accordance with the plan and immediately notify DFG and the RWQCB of any spills and cleanup procedures.
   - Provide staging and storage areas to keep equipment, materials, fuels, lubricants, solvents, and other possible contaminants away from watercourses and their watersheds.

3. **Impacts to shaded riverine aquatic (SRA) cover will be avoided or minimized.** Care will be taken to preserve sites with desirable habitat characteristics, including streambank areas with dense woody vegetation,

structurally complex and undercut streambanks, and locations with instream woody debris or large rocks. Areas where bank erosion is occurring and other disturbed areas that lack SRA cover will be considered potentially appropriate sites for facilities associated with the proposed action.

4. **Turbidity will be monitored during the instream construction season.** Monitoring will be conducted daily upstream and downstream of the project area. Increases in suspended sediment and associated turbidity values will be limited to less than 20 percent compared to background conditions (i.e., those that exist upstream of the construction sites).

5. **Sheetpile cofferdams or other water-diversion structures will be installed to prevent or minimize habitat disturbance.** The cofferdams will be designed to avoid constricting flow and substantially increasing river flow velocity. River flow velocities will not exceed 11 foot per second when adult Chinook salmon are moving upstream and will not exceed 14.5 feet per second when adult steelhead are moving through the channel. The water-diversion structures will neither obstruct more than 50 percent of the channel at any time nor direct flow to areas of the channel that have obstacles or barriers to fish passage that direct fish away from the fish ladders.

   In-water sheet pile driving and removal will take place during daylight hours and will be limited to a maximum of 10 hours per day. Studies have shown that adult fish tend to migrate at night, so limiting this activity to daylight hours is expected to reduce delay times of migrating adults.

6. **The contractor will be required to conduct pre- and post-construction bathymetric surveys and reestablish preconstruction channel elevations and contours.** These surveys will document preconstruction bed elevations and contours and ensure that they are reestablished in areas where temporary structures and construction activities (i.e., trenching and excavation) disturb the riverbed.

7. **Construction activities not affecting WID diversion operations (e.g., channel regrading) will be performed during summer months.** This will be done to minimize direct impacts to fisheries resources.

8. **A fishery biologist will be required to monitor construction activities.** A fishery biologist will be present on site during all phases of in-water construction with the authority to curtail any activity that results in mortality, physical injury or migration delays of salmon or steelhead. The fishery biologist will maintain contact with regulatory agency personnel as necessary.

A biological monitoring plan also will be prepared to obtain data on the biological and behavioral characteristics of salmon and steelhead on a pre- and post-construction basis. Biological monitoring initially will be conducted under existing conditions and will continue for a three-year period following the completion of the project.

The resident engineer will be required to notify the fishery biologist of the in-water work activity schedules. The fishery biologist for the project shall keep a complete and detailed record of all in-water construction activities including a description of the in-water work activity, the time started and completed and note any occurrence of fish presence, fish behavior during the in-water activity and any adverse effects and mortality. If mortality is observed then notification of the appropriate agencies will occur immediately so that remedial actions (e.g., use of a silt curtain or bubble curtain barrier) may be implemented.

9. **Maintenance of minimum instream flows.** River flows will be maintained throughout the construction according to the EBMUD JSA for minimum flows past Woodbridge. At no time will these flows be reduced below the JSA minimum flow for any reason.

C. Design, Operation and Maintenance Plan for the Woodbridge Dam and WID Diversion Canals

1. Adjustable Weir and Fish Ladders

The new weir will provide a constant operating water surface elevation of up to 40.6 feet MSL and is intended to allow for better flow management to meet both fishery and irrigation requirements. The improved design should direct higher attraction flows to the fish ladder entrances under variable flow conditions and reservoir operations, and should allow woody debris to pass more easily over the weir.

The weir will be automatically controlled by transducers that monitor water levels and adjust the weir height to maintain constant lake levels under changing flow conditions. A programmable logic controller (PLC) will analyze data from a downstream gage and upstream monitoring points to ensure that required flows are maintained both for downstream fish passage and for irrigation needs. Three dam panels will be operated to respond to flow changes and improve fish passage conditions over a broad range of flows.

The three fish ladders with separate entrances will be located on the right abutment of the weir. Both juvenile and adult salmon and steelhead will use the ladders for migration. Improved attraction flows from Lodi Lake and the near-dam area as flows pass over the diversion screen and ladder system will direct juvenile outmigrants to the upstream ladder entrances and adults to the downstream ladder entrances. Entrances to each of the three ladders will be independently

adjustable to allow manipulation of attraction flows as appropriate.

The main fish passage ladder will be designed to operate under high reservoir conditions when water flowing over the spillway is used to maintain continuous fish passage. The design flow of this ladder will be 75 cfs, although it will be operable with flows as low as eight cfs.

A separate fish ladder will be operated during low-stage reservoir periods and low-flow conditions (15-20 cfs). The low-stage ladder will be controlled by weirs with 1-foot-wide vertical slots; it will operate at varying flows and head, as well as under submergence conditions.

The third ladder, the "pool and chute ladder," will be located adjacent to the low-stage ladder. This ladder will be DFG-approved and will offer fish a second opportunity to pass through the dam during low-flow conditions, particularly when flows exceed the capacity of the low-stage fish ladder. The ladder will be uncontrolled except when not in use, and will operate through the full range of tailwater conditions until submergence by tailwater. The ladder will operate between 0 and 275 cfs, although its greatest efficiency will be at 275 cfs. This ladder may also be operated in conjunction with the low-stage ladder.

2. High-Stage Fish Screen and Fish Bypass Pipeline

The high-stage fish screen on the WID Diversion Canal will be made of stainless steel wedge wire with 1.75 millimeters openings. A floating debris boom and a trash rack fitted with an automated "Atlas Polar"-type rake will be located upstream from the screen to remove large debris. A vertically mounted traveling brush will sweep away small debris (e.g., leaves) that may accumulate on the screen into the bypass pipeline. The brush will be designed to travel slowly (i.e., less than the design sweeping velocity) and will be adjusted as required. All aspects of the high-stage fish screen have been designed to meet DFG, NOAA Fisheries, and USFWS criteria.

The screen will operate between 0 and 414 cfs during full reservoir conditions (lake water surface elevations between 39.5 and 40.6 feet MSL at the canal); and possibly concurrently with the low-stage fish screen (see below). The high-stage fish screen will be "V"-shaped, 99 feet long on both sides, and will be equipped with four, 4 by 7-feet-wide, motor-controlled radial gates, which will be used to regulate diversions into the canal.

Fish approaching the screen will be channeled into a 30-inch diameter bypass pipeline and transported downstream either to the smolt trap (see below) or to the Mokelumne River downstream of the weir. Flow through the fish bypass pipeline will be maintained at 8 to 12 cfs. The pipeline will be buried at grade in essentially the same location as the existing bypass pipeline, and will be constructed to NOAA Fisheries criteria.

3. Smolt Trap, Monitoring Facilities, and False Weir

Fish may be transported through the fish bypass pipeline to the smolt trap, which will be located beside the new monitoring building and weir. A 150-gallon fish transfer bucket will lift fish and water from the smolt trap into the monitoring building or to a transport truck, as appropriate, where the smolts will be measured, tagged, recorded, and returned to the river. Two transfer pipes will connect to the smolt trap. The first pipe, 12 inches in diameter with a flow rate of 1.25 cfs, will return fish to the river at a discharge point downstream of the weir. The option of transferring fish to a transport truck will facilitate release further downstream. The second pipe, 18 inches in diameter, will convey the remaining water (after removal of smolts) to the downstream discharge point. Flow velocities in the smolt trap have been selected to prevent impingement of juvenile fish. The smolt trap may be bypassed and fish transported directly to the river if no monitoring activities are scheduled.

The false weir ladder will facilitate adult fish passage during extreme low-flow conditions, when the only downstream flow is supplied by the fish bypass pipeline. Juvenile fish will not be attracted downstream through the ladder because no flow will be supplied from the reservoir.

The adult fish trap will provide an opportunity to collect data on returning adult salmon and steelhead. This trap will be located in one of the bays in the false weir ladder. After the desired data are collected, fish will be returned to the false weir ladder to continue their passage over the dam.

Infrared imaging and video cameras will allow data such as number, sex, size, etc. to be obtained for salmon and steelhead passing the high-stage and low-stage fish ladders. An acoustic imaging system, which would function in turbid water conditions, is also being considered for installation

4. 0-200 cfs Low-Stage Fish Screen and Diversion Pipeline

The low-stage fish screen will enable juvenile salmon and steelhead to pass safely beyond the diversion and into the fish ladder during winter, spring, and early summer. Attraction of juveniles to the ladder will be especially important during low-flow years, when WID's diversions can exceed downstream flows. This screen will operate between 0 and 200 cfs and will prevent fish and debris from entering the diversion pipeline. It will be approximately 95 feet long and 8 feet high, and comprised of 1.75-millimeter stainless steel wedge-wire screening, allowing for a maximum approach velocity of 0.33 feet per second. It will be cleaned by a traveling vertical brush system that will horizontally sweep debris from the front of the screen downstream into the fish ladder. A floating log boom will span the entire approach area to the fish screen and fish ladders and will deflect large debris over the weir. A trash rack will be located immediately upstream of the screen. All aspects of this screen have been designed to meet NOAA Fisheries and FWS criteria.

Water diverted through the low-stage fish screen will be conveyed approximately 1,800 feet south and west through a 10-foot-diameter, concrete pipeline to the Woodbridge Diversion Canal entrance. WID plans to divert up to 200 cfs through this pipeline until approximately June 1 of each year. Flows higher than 200 cfs will be diverted through the high-stage "V" screen at the canal entrance.

D. Monitoring Program

One goal of the proposed project is to design fish passage facilities to provide safe and effective passage of migrating adult and juvenile Chinook salmon and steelhead past the project area over a broad range of flows. To ensure that the facilities are meeting the fish passage objectives (i.e., including NOAA Fisheries and DFG design and operations criteria), the project sponsors, in consultation with member agencies of the Technical Committee, will develop and implement a fish passage monitoring and evaluation plan. Elements of the plan will include:

- A description of baseline conditions derived from existing fish passage data;
- A description of the methods, performance criteria, and protocols for evaluating fish passage improvements, addressing problems, and identifying and implementing corrective measures if necessary; and
- A monitoring and evaluation program to be conducted for a minimum of two years after the new dam, fish ladders, fish screens, and bypass pipeline are completed and operational.

EBMUD will monitor the incidence of injury and stress to fish following passage through the new facilities as part of its long-term fish monitoring program. The biological monitoring plan will be developed, evaluated, and reviewed by NOAA Fisheries before the operation of the dam begins, and will be implemented as a term and condition of this biological opinion.

The project engineer also will prepare an operations and maintenance manual that provides detailed descriptions of the activities needed to ensure long-term effectiveness and reliability of the dam and fish passage facilities. Elements of this manual will include regular inspections and maintenance of the dam, fish ladders, fish screens, and bypasses to identify and correct hydraulic conditions or other hazards (e.g., accumulations of sediment or debris) that could adversely affect performance of the facilities. The manual will be developed, evaluated, and reviewed by NOAA Fisheries before operation of the dam begins.

III. STATUS OF THE SPECIES/CRITICAL HABITAT

Central Valley Steelhead ESU

The Central Valley steelhead evolutionary significant unit (ESU) is endemic to the Central

Valley (i.e., Sacramento-San Joaquin River basin) of California. On August 9, 1996, NOAA Fisheries issued a proposed rule to list this ESU as endangered under the federal Endangered Species Act (61 FR 155). On March 19, 1998, the Central Valley steelhead ESU was listed as threatened (50 CFR Part 227), and critical habitat was subsequently designated on February 16, 2000 (50 CFR Part 226). However, pursuant to an April 30, 2002, court order, critical habitat designations for 19 ESUs of Pacific salmon and steelhead, which includes Central Valley steelhead, were vacated and remanded to NOAA Fisheries for new rulemaking to redesignate critical habitat for those 19 ESUs.

Historically, steelhead spawned and reared in most of the accessible upstream reaches of Central Valley rivers, including the Mokelumne River, and their perennial tributaries. It is likely that steelhead were also present in the upper San Joaquin River drainage. Compared to fall-run Chinook salmon (*O. tshawytscha*), steelhead generally migrated farther upstream into tributaries and headwater streams, where cool, well-oxygenated water is available year round. In the Central Valley, steelhead are now restricted to the upper Sacramento River downstream of Keswick Reservoir, the lower reaches of large tributaries downstream of impassable dams, small perennial tributaries to the Sacramento River mainstem and large tributaries, and the Sacramento-San Joaquin Delta and San Francisco Bay system. In the Mokelumne River, steelhead are currently found below Camanche Dam.

Historical records indicate that adult steelhead enter the mainstem Sacramento River in July, with peak abundance in the fall, and continue migrating through February or March (McEwan and Jackson 1996). Migration in the Lower Mokelumne River occurs from August to March, peaking in December; spawning occurs from January through April. Unlike Pacific salmon, most steelhead do not die after spawning and a small portion survive to become repeat spawners. During spawning, the female steelhead digs a redd (i.e., gravel nest) in which she deposits her eggs, which are then fertilized by the male steelhead. Egg incubation time in the gravel is determined by water temperature and varies from approximately 19 days at an average water temperature of 60° F to approximately 80 days at an average temperature of 40° F.

Steelhead fry usually emerge from the gravel 2-8 weeks after hatching (Barnhart 1986, Reynolds et al. 1993); emergence usually takes place between February and May, but sometimes extends into June in the Mokelumne River. Newly emerged steelhead fry move to shallow, protected areas along streambanks and then move to faster, deeper areas of the river as they grow into the juvenile life stage. Juvenile steelhead feed on a variety of aquatic and terrestrial insects and other small invertebrates.

Under optimal conditions (46° - 60° F), juvenile steelhead may rear in the Lower Mokelumne River throughout the year (California Department of Fish and Game 1991). Small numbers of yearling and older juvenile steelhead and/or rainbow trout have been identified at Woodbridge Dam in recent years during annual monitoring of outmigrating Chinook salmon (January-July). Young-of-the-year have also been observed from April through July (Natural Resource Scientists 1998b). As juvenile steelhead begin their downstream migration, they undergo a physiological

adaptation called smoltification that prepares them for ocean residence.

No reliable estimates of historical or current run sizes of steelhead in the Lower Mokelumne River are available. The only historical counts of adult steelhead are from returns to the Mokelumne River Fish Hatchery, which have averaged fewer than 30 fish per year since 1964 (BioSystems 1992). In recent years, small numbers of adult steelhead have been recorded migrating past Woodbridge Dam during annual monitoring of Chinook salmon runs (Natural Resource Scientists 1998a). Steelhead are imported as eggs or fry from hatcheries located on the Feather and American Rivers, reared at the Mokelumne Hatchery, and planted as yearlings in the lower Mokelumne River, either immediately below Woodbridge Dam or at New Hope Landing (Jim Smith and Michelle Workman, EBMUD, pers. comm., 2001).

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and ecosystem within the action area (FWS and NOAA Fisheries 1998). Central Valley steelhead have experienced declines in abundance in the past several decades. Major factors believed to have contributed to these declines include: blockage of steelhead from suitable spawning and rearing habitat above dams, deleterious water temperatures downstream of dams, inadequate flows and rapid flow fluctuations downstream of dams and diversion facilities, direct and indirect impacts at unscreened and poorly screened diversions, delta flows and exports; previous hatchery practices, sport fishing, loss of spawning gravels, channel modification, and loss of riparian habitat. Factors that may currently limit steelhead populations in the Lower Mokelumne River include high water temperatures, impedance of passage during critical life stages, and reduced quality and availability of habitat. Conditions downstream of Woodbridge Dam, including high water temperatures, predation, and water diversions continue to threaten outmigrating salmonids. During very dry years, EBMUD traps outmigrating fish at Woodbridge Dam and releases them into the Delta (i.e., specifically at Rio Vista in the Sacramento River) with the intent of improving smolt survival and subsequent adult returns.

A. Barriers

Since the late 1800s, dams constructed on the Mokelumne River have impeded or blocked anadromous salmonids from reaching all or a portion of their historical spawning areas. Woodbridge Dam was constructed in 1910, Pardee Dam in 1928, and Camanche Dam in 1964. Camanche Dam limits the current upstream extent of Central Valley fall-run Chinook salmon and steelhead in the Mokelumne River.

The first fish ladder at Woodbridge Dam was built in 1925. The ladder was poorly designed and failed to provide suitable passage conditions for salmon and steelhead. A more effective fish ladder was constructed in 1948 but was washed out during a flood in 1950. Finally, the existing

fish ladder was constructed in 1955. This ladder continues to provide passage for Chinook salmon and steelhead, but studies have recommended that improvements be made to reduce delays in migration. The recommended improvements include the following (BioSystems 1992; Vogel Environmental Services 1992; CALFED 1998):

1. Raise tailwater elevations and add an additional pool at the fishway entrance;
2. Provide additional attraction flow into the lower portion of the fishway;
3. Improve the operation and maintenance of the fishways;
4. Alter the spill configuration over Woodbridge Dam; and
5. Add a stilling basin and retaining wall downstream of Woodbridge Dam.

Although many deficiencies in the existing fish passage facilities have been noted, the effects of these deficiencies on salmon and steelhead migration have not been well documented. It has been hypothesized that upstream-migrating adults may be delayed at the dam because of difficulties in finding the entrance to the fish ladder, and that such delays may contribute to decreased spawning success. Radio-tracking of adult salmon during their upstream migration past Woodbridge Dam in 1994 indicated that most radio-tagged salmon passed the dam within one day of arrival, and that faster migration rates appeared to be related to storm events. No data on the rate of fish movement within the ladder are available (Cynthia Watanabe and John Nelson, DFG, pers. comm. 2001).

At Lodi Lake, another fish passage consideration is the potential for young fish to be injured as they pass over the dam and onto the rip rap immediately downstream of the dam under spill conditions, or as they pass through leaks in the flash boards. Experimental releases of juvenile Chinook salmon in the dam spill bays in 1993 and 1994 indicated that fish may be injured or killed when they pass over the spillways, but that injury or mortality depends on highly variable physical and hydraulic conditions associated with different routes over the dam, through the rip rap at the base of the dam, and downstream of the tailwater (Vogel Environmental Services 1996). An earlier report (Vogel Environmental Services 1992) issued in conjunction with this study recommended eliminating the leaks in the flash boards, adjusting the flash boards during spill periods to direct fish to the most desirable routes over the dam, and installing a stilling basin immediately downstream of the dam.

Delays in downstream migration of juveniles resulting from reduced water velocities in Lodi Lake and from inadequate fish bypass flows at the entrance to the WID Diversion Canal were cited as a potential problem. Conversely, Cramer (1995) suggested that the impoundment behind Woodbridge Dam may be an important nursery area for juvenile Chinook salmon based on evidence of substantial fry rearing in Lodi Lake and high rearing densities of Chinook salmon in off-channel ponds. No studies have been conducted to assess the extent of rearing in Lodi Lake or the lake's contribution to juvenile production.

B. Water Diversions

Water diversions reduce survival of emigrating juvenile salmonids through direct losses at unscreened or inadequately screened diversions, and indirect losses resulting from reduced stream flows. Fish screening and salvage efforts at major agricultural diversions have met with variable amounts of success, and many smaller unscreened or inadequately screened diversions continue to operate. Fish losses at diversions can result from physical injury, impingement, entrainment, or predation. Indirect mortality may result from delayed passage, increased stress, and increased vulnerability to predation (NOAA Fisheries 1994; Dan Odenweller, NOAA Fisheries, pers. comm. 2002).

Diversion impacts on anadromous fish depend on diversion timing and magnitude, river discharge levels, species (i.e., race), life stage, and other factors. Because emigrating steelhead are generally larger than emigrating Chinook salmon, steelhead may be better able to avoid the direct and indirect impacts of diversions (BioSystems 1992; Michelle Workman, EBMUD, pers. comm. 2001).

On the Mokelumne River, the size of the NSJWCD diversion intake is second only to that of the WID Diversion Canal. The north pump of the NSJWCD diversion intake is unscreened; the south pump was screened by DFG in approximately 1959. In approximately 1972, DFG determined that few salmon were being lost at the screen and turned the facility over to NSJWCD for use as a debris screen. The screen is currently in disrepair and no longer in use. Although past observations of the NSJWCD diversion indicated few losses of juvenile salmon, the design of the diversion is similar to that of a diversion on the Feather River, where salmon losses have been observed (George Heise, DFG, pers. comm. 2001; Michael Tucker, NOAA Fisheries, pers. comm. 2002). Passage success in the lower Mokelumne River may also be influenced by more than 50 unscreened pump diversions between Camanche Dam and Lodi Lake, however, the extent of losses attributable to these diversions is unknown.

C. Water Temperature

Water temperature is a primary factor limiting natural steelhead production in many Central Valley streams. Although cold water releases occur below some dams, the amount and quality of habitat available for steelhead rearing below these dams is a fraction of what was once available. In addition, cold water releases are not available below many migration barriers, or are only possible when reservoirs are at capacity. Appropriate water temperature regimes below many dams cannot be maintained at levels comparable to temperatures achieved naturally in the upper watersheds that once provided habitat (Jones & Stokes, 2000).

Elevated water temperatures in Lodi Lake during the spring out-migration period (May-June) may further increase losses by increasing the susceptibility of juvenile salmonids to predation. Mark-recapture studies conducted in May and June 1991 to assess smolt mortality in Lodi Lake indicated that the mortality of hatchery smolts released at three locations along the lower

Mokelumne River (Camanche Dam, Bruella Road, and the mouth of WID Diversion Canal) increased with increasing water temperatures and diversion flows at the canal (BioSystems 1992). Although further studies are needed to clarify the factors influencing these losses, the results suggest that some of the loss of juvenile out-migrating salmonids between Camanche Dam and Woodbridge Dam may have occurred in Lodi Lake (BioSystems 1992; Michelle Workman, EBMUD, pers. comm. 2001)

D. Flow

Reservoir operations have altered the natural flow regime of Central Valley streams by changing the frequency, magnitude, and timing of flow. These changes potentially affect all steelhead life stages. Changes in the magnitude and timing of reservoir releases can influence the timing of steelhead migration. Relatively early attraction of steelhead into tributaries can be triggered by occasional reservoir releases of cold water or the occurrence of naturally high flows early in the fall. Conversely, low flows and higher water temperatures can inhibit or delay migration to spawning areas. Unnatural and/or rapid flow fluctuations downstream of reservoirs can cause dewatering of redds and stranding of juveniles (Jones & Stokes, 2000; Jim Smith, EBMUD, pers. comm., 2001; Dennis McEwan, DFG, pers. comm., 2002, 2001).

The relationship between flow and the availability of steelhead habitat is not well understood. Several studies of in-stream flow conducted in the Sacramento River Basin for Chinook salmon also have been used to develop spawning habitat-discharge relationships for steelhead trout. These studies found that successful steelhead spawning requires flows that provide appropriate water depths and velocities over suitable spawning gravels. In addition, these studies have also found that flow also influences the suitability of water temperatures and water quality for steelhead spawning (Jones & Stokes, 2000; Dennis McEwan, DFG, pers. comm., 2002 & 2001).

Because steelhead rear year round in streams, suitable flows are necessary throughout the year in the reaches where they occur. In many streams, flows and water temperatures are most critical during the summer. The stream reaches that are presently accessible to steelhead trout often lack the summer habitat conditions needed to sustain juvenile steelhead through their freshwater rearing period. These unsuitable conditions are exacerbated by reservoir operations and water diversions that reduce summer flows, and can be particularly severe in drought years (Jones & Stokes, 2000; Dennis McEwan, DFG, pers. comm., 2002 & 2001).

E. Predation

Substantial predation on juvenile Chinook salmon by large numbers of striped bass was observed immediately downstream of Woodbridge Dam in 1993, 1998, and 1999 (Michelle Workman and Jim Smith, EBMUD, pers. comm., 2001). Temporary disorientation of smolts exiting the bypass pipe and fish ladder may have an increased susceptibility to predation. Although this does not appear to be a persistent problem, recommendations have been made to implement a predator-control program at the dam (Steven Boyd, EBMUD, pers comm., 1994; Jim Smith, EBMUD,

pers. comm., 2001)

The creation of Lodi Lake during the irrigation season significantly reduces water velocities upstream of Woodbridge Dam and may increase the travel time of juvenile salmonids through this river reach, especially during low-flow conditions. These conditions create favorable habitat for predatory fish (e.g., bass, pikeminnow) and may increase the exposure of young salmonids to these predators (Michelle Workman, EBMUD and John Nelson, DFG, pers. comm., 2001)

F. Delta Flows and Exports

The State Water Project (SWP) and Central Valley Project (CVP) export facilities in the south Delta (the Banks Pumping Plant and the Tracy Pumping Plant, respectively) adversely affect anadromous fish survival in the Delta through direct entrainment losses and indirectly by changing the magnitude and direction of flows in the Delta channels. Reduced inflow and increased diversions from the Delta have increasingly impacted anadromous and resident species by reducing both net flow through the Delta and outflow from the Delta. In addition, unscreened Delta agricultural diversions may contribute to fish losses (Jones & Stokes, 2000; Dan Odenweller, NOAA Fisheries, pers. comm., 2002)

Central Valley fall-run Chinook salmon have been the primary focus of studies to evaluate the survival of juvenile salmonids through the Delta. Poor survival of smolts diverted into the central Delta has been attributed to increased migration time, high water temperatures, predation, entrainment in unscreened agricultural diversions, and exposure to reverse flows in the central- and south-Delta channels (Jones & Stokes, 2000; Dan Odenweller, NOAA Fisheries, pers. comm., 2002).

Delta flows and exports may affect the abundance of downstream-migrating Central Valley steelhead in much the same way that they affect Central Valley fall-run Chinook salmon. A portion of the juvenile steelhead migrating to the Delta may be drawn toward the SWP Banks Pumping Plant and the CVP Tracy Pumping Plant. Although both pumping plants have louver-type fish screens that may be 90 percent effective for downstream-migrating steelhead (assuming that efficiencies for salmon apply to steelhead), high prescreening losses attributed to predation have been estimated at the SWP and CVP pumping facilities. More than 1,500 unscreened agricultural water diversions in the Delta also cause unknown losses to emigrating steelhead (Jones & Stokes, 2000; Dan Odenweller, NOAA Fisheries, pers. comm., 2002).

G. Hatchery Operations

Past and ongoing practices of transplanting steelhead from other geographic areas or drainages to Central Valley streams for supplementation purposes are recognized as a major threat to the genetic integrity and overall fitness of native steelhead stocks (61 FR 155). This threat is particularly acute on rivers where major hatchery programs sustain the bulk of the steelhead

production and have relied on non-native stocks to rebuild these runs (e.g., the American River). Consequently, decreased genetic fitness and long-term viability may have contributed to declines in the abundance of steelhead or in the ability of a steelhead population to recover from low abundance levels (Chilote, 2002; Ford, 2002; Hard, 2002; Shirley Witalis, NOAA Fisheries, pers. comm., 2002).

Hatchery production is associated with other deleterious effects to fish populations. An abundance of hatchery fish may stimulate fishing, which may increase the harvest rates of naturally produced salmon and steelhead. Hatcheries may also contribute to the spread of disease among naturally produced fish. In addition, hatcheries may lead to higher adult run sizes that exceed the spawning capacity of the river, which may reduce overall wildstock population (Jones & Stokes, 2000; Shirley Witalis, NOAA Fisheries, pers. comm., 2002).

H. Sport Fishing

Sport fishing for steelhead has been largely sustained by hatchery production, however, it still may affect the number of migrating adult steelhead that reach their spawning areas each year. Unlike salmon, steelhead generally do not die after spawning, and they may be caught by anglers on their return to the ocean. Juvenile steelhead are indistinguishable from resident rainbow trout in appearance, feeding, and other activities, and many are caught by sport anglers fishing for resident trout. On a statewide basis, DFG estimated that the fishing pressure on juvenile steelhead in 1965 exceeded that for adult steelhead (DFG 1991; Barnhart 1986).

I. Spawning Gravels

Spawning success (egg hatching and fry emergence) is highly dependent on flow, temperature, and dissolved oxygen levels during the development of embryos and growth of the fry (Barnard 1994; Kondolf 1993). Barnhart (1986) noted the existence of gravels with high permeability and few fines (less than five percent sand and silt by weight) in highly productive steelhead spawning streams. Although the numbers are unknown, it appears there is little natural production of steelhead in the Mokelumne River and this may be attributable to blockage of the recruitment of spawning-size gravels into the lower reaches of the river by Pardee and Camanche Dams. EBMUD has recently implemented a spawning gravel enhancement program in the lower Mokelumne River and has documented increased use of these spawning gravels with weekly redd surveys (EBMUD n.d).

In recent years, efforts have been made to improve the water quality and habitat conditions of the lower Mokelumne River. These improvements include a hypolimnetic cold-water-pool management strategy at Camanche Reservoir to improve water temperature conditions, cleanup of runoff from Penn Mine, and a spawning gravel enhancement program (DFG 1991; BioSystems 1993; FERC 1999; EBMUD n.d.; Wang n.d.). New minimum flows for fisheries have been established, and modifications and upgrades to the Mokelumne Hatchery are being planned (FERC 1999).

V. EFFECTS OF THE ACTION

A. Construction Activities

The LMRRP will result in the replacement of the existing Woodbridge Dam with an adjustable weir including three new fish ladders, modification of the existing fish ladder, the addition of another WID diversion intake adjacent to the new dam, and screening of both the existing and new WID diversion intakes. In-channel construction activities are expected to occur year-round from November 1, 2002 through January 30, 2004. However, construction impacts to steelhead generally are expected to be temporary and minor, and offset by the long-term benefits of the project to fish passage.

Effects of inchannel construction such as coffer dam and berm installation and removal on Central Valley steelhead are expected to include the following: temporary river channel alteration and constriction that may impede fish migration, and reduce the likelihood of spawning; increased noise levels (e.g., due to pile-driving), turbidity, and mortality of benthic invertebrates that may cause localized reductions in steelhead habitat quality (e.g., reduced food availability and feeding rates); habitat avoidance (Newcombe and MacDonald 1991; Feist et al. 1992) by steelhead, resulting in migration delay; possible injury or mortality of juveniles or adults from construction equipment or dewatering activities; and possible improved habitat quality for predatory fish (e.g., in eddies around coffer dams) that may lead to increased predation rates on juveniles. NOAA Fisheries expects many of these impacts to be minimized by various procedures included in the project description. Specifically, because at least one half of the river channel and one fish ladder will remain open at all times and because pile-driving will be limited to ten daylight hours per day, fish migration should occur relatively unimpeded at night. A fishery biologist will monitor the site for any obvious impacts to steelhead and will stop work, rescue fish, and coordinate with NOAA Fisheries as necessary to develop additional procedures to avoid and minimize impacts.

Turbidity levels will have established limits and will be monitored. Turbidity plumes generated by construction activities are expected to dissipate approximately 50 feet downstream from construction activities (Newcombe and MacDonald 1991). Although juvenile and adult steelhead may be temporarily displaced (i.e, for hours) into adjacent habitat when the streambed is disturbed during project construction, they are likely to return to the impacted site as the streambed settles. Spawning habitat, which may be most vulnerable to the impacts of increased levels of suspended sediment, does not exist in the project area. The total area of benthic habitat disturbed will be relatively small (i.e., approximately 500 square feet), and recolonization of disturbed areas by benthic invertebrates is expected to occur when construction is completed.

Replacement of the existing dam and the construction of permanent structures such as the new weir, fish ladders, fish screens, bank stabilization, and diversion canals will result in the permanent loss of 0.3 acres of aquatic habitat in the Lower Mokelumne River. However, the

project area is primarily used as a migration corridor rather than for spawning or rearing by steelhead. The negative impact of this loss of habitat to steelhead growth or production in the Mokelumne River is expected to be offset by the benefit of the resulting fish ladders and fish screens to fish passage and survival.

B. Operation of Woodbridge Dam and WID Diversion Canal

1. Effects of River Flows and Lodi Lake

During LMRRP construction, river flows will be maintained under the JSA with Lodi Lake being partially and gradually filled as the new weir is installed and becomes fully operational. Under the present operation diversion schedule, filling Lodi Lake generally takes several days to a week depending on upstream flows (Anders Christensen, WID, pers. comm. 2002). For continuous fish passage during construction, the existing fish ladder will be fully operational and the new fish ladders will be used after construction is completed. Smolts expected to outmigrate downstream whereas adult steelhead are expected to migrate upstream through the fish ladders. The constricted flow diverted to the fish ladders will provide attraction flows for fish migrating both upstream and downstream from the construction site and away from the entrance of Lodi Lake. Once the filling of Lodi Lake has reached equilibrium with outflow from the dam, there should be enough continuous flow through the dam and into the fish ladder to minimize displacement of juvenile steelhead into Lodi Lake.

2. Permanent Structures

The new and modified facilities are designed to meet current NOAA Fisheries, FWS, and DFG criteria and guidelines for fish passage and screen design and operation. The new weir is intended to allow for better flow management to meet both fishery and irrigation requirements. Automatically controlled transducers will monitor and adjust the weirs of the dam. Gate-operated airbladders will inflate and deflate by pneumatic control valves to maintain and ensure required flows for both downstream fish passage and irrigation needs. NOAA Fisheries expects that operating the dam in response to various flow conditions will improve fish passage for both juvenile and adult steelhead in the Lower Mokelumne River.

The new weir design and operation will direct higher attraction flows to the three fish ladder entrances during high- and low-flow conditions and under full- or low-reservoir conditions. Under full reservoir levels, the high-level fish ladder will operate between 8 to 75 cfs. When the reservoir is low and the operational flows can sustain between 15-20 cfs, the low-level fish ladder will be in use. The pool-and-chute ladder adjacent to the low-level ladder will give fish a second opportunity to pass over the dam during low-flow conditions and could be operated in conjunction with the low-level ladder. By operating the new fish ladders at different flow and reservoir conditions, the project is expected to improve fish passage and increase the survival of downstream and upstream migrating fish.

The high- and low-stage fish screens for the WID Diversion Canal and the new diversion pipeline, respectively, are designed to meet NOAA Fisheries screen criteria to improve downstream fish passage. They are designed to reduce potential injury and mortality caused by entrainment, impingement, and predation at the screens, and improve migration by improving flows through Lodi Lake to the fish ladder, eliminating the flow split at Woodbridge Diversion Canal during high- and low- flow conditions. During the operation of the low-stage screen, juvenile steelhead should pass safely beyond the diversion and into the fish ladder during winter, spring, and early summer. The high-stage fish screen is operated between 0 and 414 cfs during full reservoir conditions and can be operated with the low-stage fish screen between 0 and 200 cfs to maintain continuous flows for fish migration and irrigation needs. Fish approaching the high-stage fish screen will be channeled into a 30-inch bypass pipeline and transported downstream either to the smolt trap or to the Mokelumne River downstream of the weir with flows of 8 to 20 cfs. NOAA Fisheries believes some migrating juvenile steelhead transported through the bypass pipeline may potentially be injured or killed. Overall, although some take (e.g., stress, injury, mortality) of steelhead and juvenile salmon will likely continue to occur as a result of dam and fish screen operations, NOAA Fisheries expects the new facilities to significantly reduce such effects to steelhead compared to the existing dam.

The operation of the smolt trap, monitoring building, and adult fish trap will allow trapping and monitoring of fish migrating past the dam. Smolts transported through the fish bypass pipeline may be directed into the smolt trap. For holding, tagging, and recovery, a water-to-water transfer system will be used to transport the collected fish into holding tanks equipped with a flow-through water supply system. After tagging and recovery, the juvenile fish will be returned to transfer pipes leading downstream to the river. This facility should minimize handling and injuring fish and will allow migrating juveniles to be collected for monitoring purposes as part of this or other projects. Likewise, the modification of the existing fish ladder into a false weir ladder will allow returning adult steelhead to be trapped in one of the bays of the new dam so that monitoring data (e.g., size) can be collected on these fish.

VI. CUMULATIVE EFFECTS

Cumulative effects are defined as those effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Future non-federal actions that may affect the action area include continued urbanization related to increased population, and continued agricultural practices. These activities may influence Mokelumne River flow river regime (e.g., the need to increase water diversion for potable water), temperatures, sediment contribution, and degradation of water quality and quantity within non-Federal riparian areas. Presently, NOAA Fisheries is unaware of any proposed or future non-federal actions likely to occur in the action area.

VII. CONCLUSION

After reviewing the best scientific and commercial data available, including the current status of Central Valley steelhead, the environmental baseline for the action area, the effects of the proposed project, and cumulative effects, it is NOAA Fisheries biological opinion that the LMRRP Fish Passage Improvements are not likely to jeopardize the continued existence of threatened Central Valley steelhead, and are not likely to adversely modify the designated critical habitat of this species. Notwithstanding this conclusion, NMFS anticipates that some actions associated with the LMRRP Fish Passage Improvements may result in incidental take of Central Valley steelhead. Therefore, an incidental take statement is included with this Biological Opinion for these actions.

VIII. INCIDENTAL TAKE STATEMENT

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Harass is defined by intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the proposed action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are nondiscretionary, and must be undertaken by BOR so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. BOR has a continuing duty to regulate the activity covered by this incidental take statement. If BOR(1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the BOR and WID must report the progress of the action and its impact on the species to NOAA Fisheries as specified in the incidental take statement (50 CFR §402.14(i)(3)).

This incidental take statement is applicable to the construction and operation of the Lower Mokelumne River Restoration Program at the Woodbridge Dam and WID Diversion Canal as described in the final EIR/EIS issued October 2000, revised biological assessment submitted on December 18, 2001, and its addendum dated January 28, 2002.

A. Amount or Extent of Take

1. Construction Activities

Anticipated take of Central Valley steelhead due to construction activities is expected to result from the temporary loss or degradation of 0.3 acres of aquatic habitat in the Lower Mokelumne River for approximately two years, which may result in short term stress, and possible injury or mortality of juveniles and adults. Take will result from activities such as cofferdam and berm installation and removal, pile-driving, operation of heavy equipment, and dewatering of work areas, and may occur through causing avoidance of or denying access to habitat that is normally available; migration delays; stranding, handling and relocation; increased exposure to predators; and crushing. However, avoidance of the work area by steelhead is expected to reduce injury and mortality from direct contact with construction equipment or materials. NOAA Fisheries anticipates that juvenile steelhead mortality will not exceed five percent of the juvenile steelhead in the project area based on observations from a similar project involving repair of a dam (Harris 1995). Take will also occur from the permanent loss of 0.3 acres of aquatic habitat to the footprint of the project.

2. Operation of the Dam and Diversion Canals

During the operation of the dam and diversion canal, take is anticipated from diversion of flow through the WID Diversion Canal, pipelines, and fish ladders, the use of the high-and low-stage the fish screens and fish bypass pipeline, and adult and smolt traps. Because the design and operation of the proposed project should conform to NOAA Fisheries fish screen criteria, we do not anticipate take in the form of mortality during the operation of the dam, ladder, and fish screens. However, when the operation of the high-stage fish screen is triggered during full reservoir conditions, fish approaching the high-stage fish screen will be channeled into the 30-inch bypass pipeline. This may result in mortality, injury, harassment, harm, and capture of some fish. Based on the best available information, the existing bypass pipeline captures an average of 100 juvenile steelhead per year (Vogel 1995;1996; 1997; 1998; 1999; 2000; 2001). Because this high -stage fish screen is only operational during full reservoir conditions (i.e., approximately fifty percent of the time), the number of juvenile steelhead entering the fish bypass per year is not expected to exceed 50 fish.

A. Effects of the Take

The net effect of the proposed action should be beneficial to adult and juvenile steelhead in the long term and will not jeopardize the continued existence of Central Valley steelhead. The proposed action will enhance and improve fish passage in the lower Mokelumne River, resulting in better steelhead access to favorable spawning and rearing habitat in the upper reaches of the Mokelumne River above Woodbridge Dam, and increased survival of juvenile outmigrants due to improved fish screen design at the WID diversion canal and reduced predation. This will

contribute to the survival and recovery of steelhead in the Mokelumne River and of the Central Valley steelhead ESU overall.

B. Reasonable and Prudent Measures

NOAA Fisheries believes the following reasonable and prudent measures are necessary and appropriate to minimize take of Central Valley steelhead:

1. BOR and WID shall minimize harm, harassment, and mortality of juvenile Central Valley steelhead from cofferdam and berm construction, dewatering of work areas, and dam construction.
2. BOR and WID shall minimize the adverse effects of pile driving and other sound/vibratory equipment during construction on adult and juvenile Central Valley steelhead.
3. BOR and WID shall avoid or minimize loss of riparian and SRA habitat on the lower Mokelumne River associated with construction of the proposed facilities, and ensure that losses of riparian and SRA cover are fully compensated with no net loss of habitat values.
4. BOR and WID shall minimize the adverse effects from discharge on adult and juvenile Central Valley steelhead.
5. BOR and WID shall minimize impacts associated with any fish rescue and activities
6. BOR and WID shall evaluate the performance of the newly constructed facilities and ensure that the facilities are operated and maintained to meet accepted performance standards of NOAA Fisheries.
7. BOR and WID shall notify NOAA Fisheries of any requests from agencies or other organizations to use their fish counting facilities (i.e., adult and smolt trap).
8. All requested reports shall be submitted to

Rodney McInnis
Acting Regional Administrator
National Marine Fisheries Service
Sacramento Area Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

C. Terms and Conditions

BOR must comply or ensure compliance by WID or its contractors with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. BOR and WID shall minimize harm, harassment, and mortality from cofferdam and berm construction, dewatering of work areas, and dam construction on Central Valley steelhead.

   a. Sheetpiles, cofferdams, and other in-water structures shall not constrict flow to a degree that would prevent upstream passage of adult salmon and steelhead. During in-water construction activities, a continuous migration path must be maintained past the project site. The project description states that water velocities will not exceed 14.5 feet per second when adult steelhead are migrating upstream through the project area, flow will not be directed toward fish passage barriers or away from fish ladders, and that no more than 50 percent of the channel will be obstructed at any time. NOAA Fisheries further stipulates that the migration period of adult steelhead through the project area be interpreted as December 15 through March 15, and that the 50 percent of the stream channel that is free of obstruction be contiguous.

   b. The general contractor(s) shall develop and implement a Hazardous Materials Control and Spill Prevention and Response Plan that will include all of the elements outlines in the project description, and will be implemented before the construction phase of the Proposed action begins. Additionally, construction equipment and vehicles will be refueled in the flood plain only within a designated, paved area with a berm where spills will be readily contained and cleaned up.

   c. Litter and construction debris shall be removed from below the OHW line before any suspensions of work lasting longer than one week, and disposed of at an appropriate site. All litter, debris, equipment, and supplies shall be removed from the construction staging areas above the OHW within the river channel at the end of each construction season.

   d. A representative shall be appointed by BOR or WID who will be the contact for any employee or contractor who might incidentally take a listed salmon or steelhead species or who finds a dead, injured, or entrapped salmon or steelhead. This representative shall be identified to all employees during an employee education orientation session on impacts of construction activities that may affect listed salmon or steelhead. The orientation session shall be conducted by a qualified fisheries biologist and cover specific measures to prevent injury to listed fish and the actions to take if listed fish are found injured.

   f. NOAA Fisheries Sacramento Office (contact: Mike Aceituno, (916) 930-3600) shall be notified within 24 hours if one or more salmon or steelhead are found injured or dead and shall review the activities resulting in take to determine whether additional protective measures are required. Written

notification shall follow within 48 hours and shall include the date, time, and location that the carcass or injured specimen was found, a color photograph, cause of injury or death, and name and affiliation of the person who found the specimen. Any dead specimen should be placed in a cooler with ice and held for pickup by NOAA Fisheries.

g. A written report shall be provided to NOAA Fisheries regarding water quality, fisheries, and other habitat impacts associated with the instream construction activities of WID within 60 days of completion of the instream construction activities. The report shall include, at a minimum, a description of any problem encountered during the project or implementation of terms and conditions, and any effect associated with the instream construction activities on steelhead that was not previously considered.

2. BOR and WID shall minimize the adverse effects of pile driving and other sound/vibratory equipment during construction on adult and juvenile Central Valley steelhead.

   a. Pile driving, berm construction, rip rap installation, and other noise/vibratory operations on the Lower Mokelumne River in association with construction of the fish passage and screen facilities shall be limited to a maximum of 16 hours per day.

   b. Piles shall be composed of wood, plastic, concrete, or steel, and must be free of coatings or treatments that may leach into the surrounding environment and adversely affect listed species.

3. BOR and WID shall avoid or minimize the loss of SRA habitat on the lower Mokelumne River associated with construction of the proposed facilities, and ensure that losses of riparian and SRA cover are fully compensated with no net loss of habitat values.

   a. If requested, during or upon completion of construction activities, BOR, WID, or contractors shall accompany NOAA Fisheries personnel on an inspection of the construction sites to review project impacts on steelhead and their habitat.

   b. Care shall be taken to preserve sites with more desirable habitat characteristics, including stream bank areas with dense woody vegetation and SRA cover, structurally complex and undercut streambanks, and locations with instream woody debris or large rocks. Potential sites appropriate for facilities associated with the proposed action include sites where bank erosion is occurring, or other disturbed areas lacking SRA cover. A pre-construction report evaluating the project site and proposed area for revegetation should be

provided to NOAA Fisheries for review 30 days in advance of the start of construction activities.

c. Riparian vegetation restoration shall occur at a 3:1 replacement ratio for areas disturbed or removed as a result of the proposed action. As such, there will be a net gain in habitat quantity, and no net loss in habitat quality. BOR shall ensure that NOAA Fisheries has the opportunity to review the tree/vegetation removal plan and the revegetation plan 30 days in advance of removal operations. Replacement vegetation should consist of native plant species appropriate for riparian ecotones. Irrigation should be provided to ensure plant viability and remediation undertaken if re-establishment of riparian vegetation is unsuccessful.

d. BOR and WID shall provide a written report to NOAA Fisheries detailing riparian vegetation reestablishment five years after completion of the instream construction activities. The report shall include, at a minimum, a description of any problem encountered during the reestablishment of riparian vegetation and a comparison of pre-and post-project vegetation focusing on species, acreage affected, and plant densities.

4. BOR and WID shall minimize the adverse effects from discharge and disturbance of instream sediments on adult and juvenile Central Valley steelhead.

   a. The general contractor(s) shall develop and implement an erosion-control plan and obtain necessary permits and clearances for construction activities as outlined in the project description. BOR and WID shall supply NOAA Fisheries with copies of the erosion control plan and all permits 30 days in advance of the start of construction activities.

   b. All water pumped during de-watering activities shall be routed to either: (1) a sedimentation pond located on a flat stable area above the OHW level and outside of the river levees that prevents silt-laden runoff to enter the river, or (2) a sedimentation tank/holding facility that allows only clear water to return to the river and includes disposal of settled solids at an appropriate offsite location.

   c. All rock piles and the plunge pool below the existing dam shall be graded to minimize impacts, injury or harm to salmonid and to assure safe passage of salmonids during outmigration. The plunge pool should be filled and the area graded to a natural stream bed riffle configuration, which will be less likely to support predatory fish.

5. BOR and WID shall minimize impacts associated with any fish rescue activities.

a. The methodology that BOR and WID use to capture and relocate steelhead shall be efficient and minimize the stress and exhaustion of fish. Steelhead shall be counted as they are captured and/or relocated by a qualified fisheries biologist. The following guidelines shall be followed for relocating fish:

i. Notify NOAA Fisheries a minimum of 48 hours prior to capture and relocation of steelhead to provide NOAA Fisheries staff an opportunity to participate.

ii. The NOAA Fisheries "Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act" (June 2000) shall be followed during any electrofishing with the following exception: *Sample Processing and Record keeping, #3.* Anesthetizing salmonids is not permitted under this Incidental Take Statement, nor are physical measurements of salmonids, scale samples, fin clips, tagging, etc.

iii. Handling of steelhead shall be minimized.

iv. Steelhead shall be kept in cool, shaded, aerated water protected from noise or jostling any time they are not in the stream and fish shall not be removed from this water except to be released.

v. Steelhead shall not be overcrowded in buckets, with a minimum of six cubic inches of water provided per young-of-year individual (i.e., 39 fish per gallon of water), and 10 cubic inches of water provided per fish for older or larger individuals (i.e., 23 fish per gallon of water).

vi. Steelhead shall be sorted by size classes to minimize predation, or provide a stable YOY escape shelter that will not move and crush fish during transportation.

vii. Species identification estimates of number of individuals and length shall be made visually without handling fish. If a positive identification cannot be made, this fact should be recorded rather than handling fish to make a positive identification. Length estimates are to be used to estimate age class; no population estimates or growth rates will be determined from this information.

viii. All estimates of number of steelhead and approximate lengths shall be submitted to the NOAA Fisheries Sacramento Office within five days

of their capture and release. Reports shall indicate the level of accuracy of visual estimates (e.g.,10 to 20 YOY steelhead).

6. BOR and WID shall evaluate the performance of the newly constructed facilities and ensure that the facilities are operated and maintained to meet accepted performance standards of NOAA Fisheries.

   a. A draft hydraulic evaluation plan shall be submitted to NOAA Fisheries before construction of the project is completed. The plan shall be finalized within the first year of operation and shall outline in detail a proposed methodology for measuring near-screen velocities under conditions least favorable to migrating juvenile salmonids, as outlined in *Guidelines for Developing Post-Construction Evaluation & Assessment Plans, and Operations & Maintenance Plans*, a document available through the NOAA Fisheries Anadromous Fish Screen Program. Entrainment studies may be waived if NOAA Fisheries engineering staff members (1) are involved in the review and approve the fish screen design, (2) inspect the completed fish screen in the dry, and (3) find materials and workmanship to be within specifications for the protection of juvenile steelhead.

   b. NOAA Fisheries staff members, including SCUBA diving personnel, shall be granted access to the site for inspection and measurement of fish-screen performance. NOAA Fisheries will provide a minimum of 48 hours notice to BOR and WID in advance of any inspections.

   c. In the event that the fish screen is damaged and the protection of juvenile fish may be compromised, BOR and WID shall notify NOAA Fisheries within 48 hours and shall cease diversions through damaged or missing screen panels to the greatest extent possible.

   d. A operations and maintenance plan for the dam, fish passage facilities, and fish screens shall be developed and submitted to NOAA Fisheries before diversions are initiated. The plan shall be finalized within the first year of operation.

   e. An operations and maintenance log book shall be maintained on a weekly basis. The log book shall be made available for inspection to NOAA Fisheries personnel with 24 hours notice.

7. BOR and WID shall notify NOAA Fisheries of any requests from agencies or other organizations to use their fish counting facilities (i.e., adult and smolt trap).

a. If the fish counting facilities are to be used for other than the sole purpose of monitoring and evaluating the operation and performance of the dam and diversion canals, BOR and WID shall notify NOAA Fisheries.

b. NOAA Fisheries staff shall be provided the opportunity to coordinate with the requesting agency or organization to evaluate the purpose of their proposed project and facilitate compliance with the ESA. BOR and WID must ensure that users of the fish counting facility have all appropriate permits and clearances from NOAA Fisheries in hand prior to the start of any project.

VII. Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop additional information.

NOAA Fisheries believes the following conservation recommendations are consistent with these obligations, and therefore should be implemented by BOR and WID.

1. BOR and WID should continue to work cooperatively with other state and federal agencies, private landowners, governments, and local watershed councils to identify opportunities for cooperative analysis and funding to support salmonid habitat restoration projects within the lower Mokelumne River.

2. To maintain current knowledge of important fish production areas and the overall success of habitat protection and restoration efforts, BOR and WID should continue to conduct stream surveys and monitor fish populations on the lower Mokelumne River.

3. To keep NOAA Fisheries informed about the actions that are intended to minimize or avoid adverse effects, or that benefit listed or proposed Pacific salmonids or their habitat, NOAA Fisheries requests notification of the implementation of these conservation recommendations.

VIII. Reinitiation of Consultation

Reinitiation of formal consultation is required if there is discretionary Federal involvement or control over the action and if (1) the amount of extent of taking specified in any incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the actions subsequently modified in a manner that causes an effect to the listed species that was not

considered in the biological opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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Enclosure 2

Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS[1]

Lower Mokelumne River Restoration Program: Fish passage Improvements on the Woodbridge Dam and WID Diversion Canals

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended (U.S.C. 180 et seq.), requires that Essential Fish Habitat (EFH) be identified and described in federal fishery management plans (FMPs). Federal action agencies must consult with the National Marine Fisheries Service (NOAA Fisheries) on any activities which they fund, permit, or carry out that may adversely affect EFH. NOAA Fisheries is required to provide EFH conservation and enhancement recommendations to the federal action agencies.

EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purposes of interpreting the definition of EFH, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle.

The Pacific Fishery Management Council (PFMC) has identified and described EFH, Adverse Impacts and Recommended Conservation Measures for salmon in Amendment 14 to the Pacific Coast Salmon Plan (Salmon Plan) (PFMC 1999). Freshwater EFH for Pacific salmon in the Central Valley includes the waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers et al. (1998), and includes both the Lower and Upper Mokelumne River hydrologic units (i.e., numbers 18040005 and 18040012, respectively). The Mokelumne River supports Central Valley fall-/late fall-run chinook salmon (*Oncorhynchus tshawytscha*), which occur upstream as far as Camanche Dam (i.e., the upstream limit of EFH [PFMC 1999]).

Life History and Habitat Requirements

General life history information for Chinook salmon is summarized below. Further detailed

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information on Chinook salmon ESUs is available in Myers et al. (1998).

Upstream migrating adult Chinook salmon enter the Mokelumne River from August through December and generally pass Woodbridge Dam between mid-September and mid-December. Analyses of salmon migration past Woodbridge Dam in relation to a number of environmental variables (e.g., flow, water temperature) have revealed no consistent patterns (BioSystems 1992, Natural Resource Scientists 1999). Water temperatures in the lower Mokelumne River during the early upstream migration period can exceed published maximum temperatures suitable for egg development (57-59° F), although the effects of these temperatures on prespawning survival of adults and on egg viability have not been well documented (BioSystems 1992).

Central Valley fall-run Chinook salmon usually spawn from October to January, with spawning peaking in December. Nearly all Chinook salmon immigrating to the Mokelumne River spawn in the upper 6 miles of the lower Mokelumne River. Chinook salmon females deposit their eggs in nests, or redds, which they excavate in the gravel bottom, and the eggs are fertilized by one or more males. Adult salmon die after spawning. Chinook salmon eggs generally hatch in 6-9 weeks and yolk-sac larvae remain in the gravel for several more weeks.

Immediately or soon after emergence (January-March), some of the Chinook salmon less than 50 millimeters long, called fry, begin a distinct downstream movement into the lower Mokelumne River. The fish that remain above Woodbridge Dam (juveniles) continue to rear in calm, marginal areas of the river, particularly back eddies, behind fallen trees, near undercut tree roots or over areas of bank cover (Lister and Genoe 1970), and emigrate as smolts from April through June. Smolts are juvenile salmonids that are undergoing a physiological transformation that allows them to enter saltwater; they also lose their markings and appear silvery. The consistency in size of outmigrating smolts that pass Woodbridge Dam from year to year strongly suggests that some juveniles rear upstream until they reach a specific size and then migrate.

Principal foods of Chinook while rearing in freshwater and estuarine environments are larval and adult insects and zooplankton such as *Daphnia*, flies, gnats, mosquitoes or copepods (Kjelson et al. 1982), stonefly nymphs or beetle larvae (Chapman and Quistdorff 1938), as well as other estuarine and freshwater invertebrates.

II. PROPOSED ACTION

The proposed action is described in Part II of the preceding biological opinion for the threatened Central Valley steelhead ESU.

III. EFFECTS OF THE PROJECT ACTION

The Mokelumne River is one of the few tributaries to the San Joaquin River that still supports populations of Central Valley Chinook salmon. Approximately six miles of suitable spawning habitat remain above the Woodbridge Dam. This area is only accessible if adults are capable of

migrating past Woodbridge Dam. In addition, habitat above and below the dam may function as valuable rearing habitat, providing food and cover for juvenile salmon. Improvements to the Woodbridge Dam and its associated structures likely will improve the health and survival of migrating adult and juvenile fall-run Chinook salmon by improving passage of adults and juveniles past the dam, reducing the of predation on juveniles, reducing loss of juveniles to an inadequately screened diversion, and improving water temperatures (under some conditions) below the dam. Construction and replacement of the dam and its associated structures will result in the temporary loss or destruction of some shaded riverine aquatic (SRA) habitat, temporary increases in turbidity and impedance of fish passage, and permanent loss of 0.3 acres of habitat to the footprint of the project. However, the overall benefits of the proposed action should improve habitat quality and access to spawning habitat above Woodbridge Dam.

IV. CONCLUSION

Based on the best available information, NOAA Fisheries believes that some aspects of the proposed Lower Mokelumne River Restoration Program Fish Passage Improvement Project are likely to adversely affect EFH for Central Valley fall-/late fall-run Chinook salmon managed under the Salmon Plan.

V. EFH CONSERVATION RECOMMENDATIONS

The habitat requirements of Central Valley fall-/late fall-run Chinook salmon within the action area are similar to those of Central Valley steelhead (*Oncorhynchus mykiss*) addressed in the preceding biological opinion. Therefore, NOAA Fisheries recommends that the following elements of the preceding biological opinion be adopted as EFH conservation recommendations:

- Reasonable and Prudent Measures numbers 1 through 4, and 6, and their respective Terms and Conditions listed in the Incidental Take Statement; and

- Endangered Species Act Conservation Recommendations numbers 1 and 2.

Section 305(b)4(B) of the MSFCMA requires Reclamation to provide NOAA Fisheries with a detailed written response within 30 days, and 10 days in advance of any action, to the EFH conservation recommendations, including a description of measures adopted by Reclamation for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR § 600.920[j]). In the case of a response that is inconsistent with our recommendations, Reclamation must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NOAA Fisheries over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

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